

Effects of Reducing Children's Television and Video Game Use on Aggressive Behavior

A Randomized Controlled Trial

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Context: The relationship between exposure to aggression in the media and children's aggressive behavior is well documented. However, few potential solutions have been evaluated.

Objective: To assess the effects of reducing television, videotape, and video game use on aggressive behavior and perceptions of a mean and scary world.

Design: Randomized, controlled, school-based trial.

Setting: Two sociodemographically and scholastically matched public elementary schools in San Jose, Calif.

Participants: Third- and fourth-grade students (mean age, 8.9 years) and their parents or guardians.

Intervention: Children in one elementary school received an 18-lesson, 6-month classroom curriculum to reduce television, videotape, and video game use.

Main Outcome Measures: In September (preintervention) and April (postintervention) of a single school year, children rated their peers' aggressive behavior and reported their perceptions of the world as a mean

and scary place. A 60% random sample of children were observed for physical and verbal aggression on the playground. Parents were interviewed by telephone and reported aggressive and delinquent behaviors on the child behavior checklist. The primary outcome measure was peer ratings of aggressive behavior.

Results: Compared with controls, children in the intervention group had statistically significant decreases in peer ratings of aggression (adjusted mean difference, -2.4% ; 95% confidence interval [CI], -4.6 to -0.2 ; $P=.03$) and observed verbal aggression (adjusted mean difference, -0.10 act per minute per child; 95% CI, -0.18 to -0.03 ; $P=.01$). Differences in observed physical aggression, parent reports of aggressive behavior, and perceptions of a mean and scary world were not statistically significant but favored the intervention group.

Conclusions: An intervention to reduce television, videotape, and video game use decreases aggressive behavior in elementary schoolchildren. These findings support the causal influences of these media on aggression and the potential benefits of reducing children's media use.

Arch Pediatr Adolesc Med. 2001;155:17-23

VIOLENCE IS pervasive in television, movies, and video games. Children's television programming contains even more violence than prime-time programming; it has been estimated that by the age of 18 years, US children witness 200 000 acts of violence on television alone.¹

The relationship between media violence and aggressive behavior has been the focus of more than 1000 studies. Exposure to violent media appears to produce 3 effects on children: (1) direct effects, in which children become more aggressive and/or develop more favorable attitudes about using aggression to resolve conflicts; (2) desensitization to violence and the victimization of others; and (3) beliefs that the world around them is mean and scary. Evidence

for these effects comes from laboratory experiments,²⁻⁴ field experiments in which children's aggression was monitored after exposure to violent media,^{5,6} natural experiments that monitored levels of aggression after the initial introduction of television into a community,⁷ retrospective, cross-sectional and prospective observational studies,^{8,9} and ecological studies.^{10,11} Reviews of the literature come to a consensus that exposure to media violence increases children's aggressive attitudes and behaviors.^{1,12,13}

For editorial comment see page 13

Despite substantial evidence that exposure to violent media is associated with increased aggression, few potential solu-

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SUBJECTS AND METHODS

All third- and fourth-grade students in 2 public elementary schools in a single school district in San Jose, Calif, were eligible to participate. Schools were sociodemographically and scholastically matched by district personnel. School principals and teachers agreed to participate prior to randomization. Parents or guardians provided signed written informed consent for their children to participate in assessments, and for their own participation in telephone interviews. One school was randomly assigned to implement a program to reduce television, videotape, and video game use. The other school was assigned to be an assessments-only control. Because only 2 schools were randomized, this may also be considered a quasi-experimental design. All assessments were performed by trained staff, blinded to the experimental design, at baseline (September 1996) and after the completion of the intervention (April 1997). Participants and school personnel, including classroom teachers, were informed of the nature of the intervention and assessments, but aggression was only one of several outcomes assessed. The beneficial effects of this intervention on adiposity in this same trial have been previously reported.¹⁴ The study was approved by the Stanford University Panel on Human Subjects in Research (Palo Alto, Calif).

INTERVENTION

The intervention was based on Bandura's social cognitive theory,¹⁵ and has been previously described.¹⁴ It consisted of eighteen 30- to 50-minute classroom lessons taught by the regular third- and fourth-grade classroom teachers (trained by the research staff) as part of the standard curriculum in the intervention school. The majority of lessons were taught during the first 2 months. Early lessons included self-monitoring and reporting of television, videotape, and video game use to motivate children to want to reduce the time they spent in these activities. These lessons were followed by a TV Turnoff¹⁶ during which children were challenged to watch no television or videotapes and play no video games for 10 days. After the turnoff, children were encouraged to follow a 7 hour per week television, videotape, and video game budget. To help with budgeting, each household also received an electronic television time manager (TV Allowance, Miami, Fla). Additional lessons taught children to become "intelligent viewers" by using their viewing and video game time more selectively. Several final lessons enlisted children as advocates for reducing media use. Parent newsletters were designed to motivate parents to help their children stay within their budgets, and suggested strategies for limiting television, videotape, and video game use for the entire family. We allowed parents to decide whether to include computer use in their child's budget. The intervention targeted media use alone and did not address aggressive behavior.

CHILD SELF-REPORT MEASURES

At baseline and posttest, on the same days in both schools, children completed self-report questionnaires during a 40-minute class period on 2 days, Tuesdays through Fridays. A research staff member read each question out loud and students were instructed to follow along together. Classroom teachers did not participate in assessments.

Demographics and Media Use

Children reported their date of birth, age in years, sex, number of televisions in their home, the number hooked up to a VCR, the number of video game players hooked up to a television, the number of portable video game players, and their hours of television, videotape, and video game use.¹⁴

Peer Ratings of Aggressive Behaviors

On the second assessment day at each time point, children responded to a peer nomination survey, modeled after the instrument developed by Eron et al¹⁷ and Walder et al.¹⁸ These instruments have been demonstrated to be highly reliable and to have criterion, construct, and predictive validity.^{17,19,20} Children were asked to respond to 15 questions about the behavior of their classmates. The first question was a "warm-up" (Who sits next to you in class?). The next 14 questions included 10 aggressive behavior items (eg, Who often says "Give me that"? Who starts a fight over nothing? Who pushes or shoves children?) interspersed with 2 popularity items (eg, Who are the children you would like to have for your best friends?) and 2 prosocial items (eg, Who helps other children?). Questions were read aloud and each page was color coded and contained a single question at the top, so data collection staff could be sure that every child was on the correct item. Below each question there were 2 columns of names, one listing all the boys in that classroom and the other listing all of the girls in that classroom. Each list also contained an option for "no boy" or "no girl." Children were instructed to choose as many students as they wanted to answer each question, by marking the box next to the name, but not to nominate themselves. Responses are scored as the number of times a student is nominated divided by the number of other students completing the survey. In this study sample at baseline, internal consistency was high for the aggression items (Cronbach $\alpha = .97$), and aggressive behavior scores were inversely correlated with popularity and prosocial scores ($r = -0.21$, $P = .002$ and $r = -0.39$, $P < .001$, respectively).

Perceptions of a Mean and Scary World

Children responded to 12 items assessing their perceptions of a mean and scary world (eg, Do you think most people are mean or most people are friendly? How important is it to know how to fight? Are you scared of being hurt by a criminal?) with dichotomous answer options. These items were adapted from instruments previously demonstrated to correlate with the amount of television viewing

tions have been evaluated. In the current multimedia, multichannel, remote control environment where heavy media use is the norm, a question of great clinical, practical,

and policy importance is: Will reducing television, videotape, and video game use decrease aggressive behavior? Therefore, we conducted a randomized, controlled,

among young adolescents²¹ and children.^{8,22} In this sample at baseline, internal consistency was moderately high (Cronbach $\alpha = .61$).

PLAYGROUND OBSERVATION OF AGGRESSIVE BEHAVIORS

A 60% random sample of participating children was selected from class lists for direct observation of aggressive behaviors during free play on the school playgrounds during recess. The protocol was based on the procedure used by Joy et al.⁷ At both baseline and posttest, observations of the same children occurred over the same 10 days in both schools. A total of 8 trained observers, blinded to the experimental design, were each randomly assigned to 1 of the 2 schools on a daily basis (4 per school). Observations occurred during morning and after-lunch recesses. Each observer was given a different random order of children. For each child, observers categorized all aggressive acts during a 1-minute period according to specific classification criteria for verbal and physical aggression. Every 15th child for each observer was a duplicate observation to assess interrater reliability. At baseline, this protocol produced 886 one-minute observations of 109 children (range, 3-13 observations per child), of which 78 were co-observations. At posttest there were 1050 one-minute observations of 101 children (range, 5-17 observations per child), of which 126 were co-observations. Interrater reliability for co-observations was high at both baseline (percent agreement=0.96 and $\kappa = 0.88$ for physical aggression; percent agreement=0.83 and $\kappa = 0.65$ for verbal aggression) and posttest (percent agreement=0.94 and $\kappa = 0.60$ for physical aggression; percent agreement=0.87 and $\kappa = 0.50$ for verbal agreement) and intrachild stability between observations was also high (baseline intraclass Spearman $r = 0.89$ for physical aggression, $r = 0.70$ for verbal aggression; posttest $r = 0.61$ for physical aggression, $r = 0.51$ for verbal aggression).

PARENT MEASURES

Parents were interviewed by telephone at baseline and posttest by trained interviewers, following a standardized protocol. At least 10 call attempts were made at various times of day and up to 3 messages were left on answering machines before classifying a parent as a nonrespondent. Mothers or female guardians were requested for telephone interviews, but fathers or male guardians were interviewed if mothers were not available. All parent interviews were completed within a 23-day period at baseline and a 36-day period at posttest, with more than 85% of interviews completed during the first 16 days of each assessment period.

Demographics and Media Use

Parents reported the ethnicity of their child, highest level of education completed for all parents or guardians living in the household, marital status, child's typical school day and weekend television, videotape, and video game use,¹⁴ and overall household television viewing patterns.²³

Parent Reports of Children's Aggressive and Delinquent Behaviors

The parent report form of the Child Behavior Checklist²⁴ is widely used to assess behavioral problems and social competencies of children aged 4 through 16 years. It has strong psychometric properties and has been the subject of many empirical studies. For this study, parents responded to the 33 items that make up the Delinquent Behavior and Aggressive Behavior subscales. The developers have reported 1-week test-retest reliabilities of 0.86 for delinquent behaviors and 0.91 for aggressive behaviors, and interparent agreement of 0.78 and 0.77, respectively.²⁴

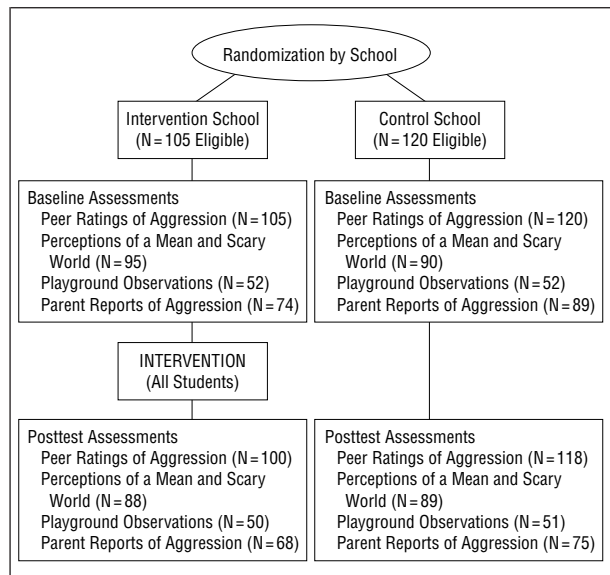
STATISTICAL ANALYSIS

Baseline comparability of treatment and control groups was assessed using nonparametric Wilcoxon rank sum tests for scaled variables and χ^2 tests for categorical variables. The primary objective of this study was to evaluate the effects of the intervention on aggressive behavior. Because of its strong psychometric characteristics, including predictive validity,¹⁷⁻²⁰ and its potential availability on all eligible children in both schools, peer ratings of aggressive behavior were identified a priori as the primary outcome measure of aggression. Additional measures were considered secondary outcomes: playground observation of physical and verbal aggression, which assesses aggression at school, and parent ratings of aggressive and delinquent behavior, which would be expected to reflect behavior in the family context. Assessing multiple measures from different sources has been recommended to examine whether the findings replicate across the measures despite the flaws and limitations of each.^{25,26} Perceptions of a mean and scary world were measured with a single scale.

Randomization was by school. Because subjects within a school may have correlated responses, we used a mixed model analysis of covariance approach (SAS MIXED procedure, SAS version 6.12; SAS Institute Inc, Cary, NC), which adjusts for observed between-subjects correlations within schools.²⁷ To test the primary hypotheses, we used an analysis of covariance with the posttest measure as the dependent variable, the intervention group (intervention vs control) as the independent variable, and the baseline measure of the dependent variable, age, and sex as covariates. Each outcome was also tested for treatment \times age and treatment \times sex interactions. Intraclass correlation coefficients ranged from -0.004 to 0.006 for all outcome measures (as would be expected from random variation). Confirmatory analyses using standard analysis of covariance (not adjusting for between-subjects correlations within schools) produced the same results, indicating that intraclass correlation coefficients were approximations of 0. All analyses were completed on an intent-to-treat basis, such that all students were analyzed in their schools as randomized, regardless of their participation in or compliance with the intervention or their school at posttest, and all available data were included in the analyses. All tests of statistical significance were 2 tailed with $\alpha = .05$. With an anticipated sample size of approximately 100 participants per group, and the above analysis, the study was designed to have 80% power to detect an effect size of 0.20 or greater.²⁸

school-based trial of reducing third- and fourth-grade children's television, videotape, and video game use to assess the effects on aggressive behavior and attitudes. We

hypothesized that, compared with controls, children exposed to the intervention would decrease their levels of aggressive behavior, as measured by peer, parent, and ob-



Study design and participant flow.

servational measures of aggression, and decrease their perceptions of the world as mean and scary.

RESULTS

The study design and participation are illustrated in the **Figure**. Baseline and posttest peer ratings of aggression were available for 100 (95.2%) of 105 eligible children in the intervention school and 118 (98.3%) of 120 eligible children in the control school. Eighty-eight children (83.8%) in the intervention school and 89 children (74.2%) in the control school completed the mean and scary world surveys, at both baseline and posttest assessments. Self-reports were excluded in the analysis for 11 children, across both schools, whose teachers classified them as having limited English proficiency or a significant learning disability. Intervention and control participants were comparable in age (mean [SD] = 8.9 [0.6] years vs 8.9 [0.7] years; $P = .80$), sex (48.0% vs 51.7% girls; $P = .59$), mean (SD) number of televisions in the home (2.7 [1.3] vs 2.7 [1.1]; $P = .59$), mean (SD) number of video game players (1.5 [2.3] vs 1.6 [1.7]; $P = .44$), and percentage of children with a television in their bedroom (43% vs 43%; $P = .98$).

Fifty intervention schoolchildren and 51 control schoolchildren were observed for physical and verbal aggression during recess for at least 3 one-minute periods at both baseline and posttest. Observed intervention and control children were comparable in age (mean [SD] = 9.1 [0.6] years vs 9.0 [0.7] years; $P = .72$), sex (40.0% vs 49.0% girls; $P = .36$), mean (SD) number of televisions in the home (2.8 [1.5] vs 2.9 [1.1]; $P = .29$), mean (SD) number of video game players (1.4 [2.7] vs 1.2 [2.1]; $P = .96$), and percentage of children with a TV in their bedroom (46% vs 47%; $P = .95$).

Baseline and posttest telephone interviews were completed by 68 (71.6%) and 75 (72.8%) of the parents of participating children in the intervention and control schools, respectively. Among this subsample of parents who completed interviews, intervention school parents

reported greater maximum household educational levels than control school parents (45% vs 21% college graduates; $P = .01$) but did not differ significantly in ethnicity (80% vs 70% white; $P = .19$), sex of respondent (82% vs 88% female; $P = .33$), or marital status (77% vs 67% married; $P = .22$).

PARTICIPATION IN THE INTERVENTION AND CHANGES IN MEDIA USE

Intervention participation and effects of the intervention on media use have been previously reported.¹⁴ To summarize, teachers reported teaching all lessons, 95 (90%) of 106 students in the intervention school participated in at least some of the TV Turnoff, and 71 (67%) completed the entire 10 days without watching television and videotapes or playing video games. During the budgeting phase of the intervention, 58 (55%) of the students stayed under their budget for at least 1 week. Forty-four parents (42%) returned slips reporting they had installed the TV Allowance system and 29 families (27%) requested 1 or more additional TV Allowance systems. In response to the intervention, children in the intervention school significantly decreased their television viewing, compared with controls, according to both child and parent reports (relative reductions of about one third). Intervention children also reported significantly greater reductions in video game use than controls, and had greater, but not statistically significant, decreases in parent reports of children's video game use, parent and child reports of videotape viewing, and parent reports of overall household television viewing. There were no significant group \times sex or group \times age interactions for any of the media use outcomes.¹⁴

EFFECTS OF THE INTERVENTION ON AGGRESSIVE BEHAVIOR AND PERCEPTIONS OF A MEAN AND SCARY WORLD

Results are presented in the **Table**. At baseline, intervention and control groups were comparable on peer ratings of aggression ($P = .34$), observed physical aggression ($P = .98$), observed verbal aggression ($P = .89$), parent reports of aggressive behavior ($P = .89$), and parent reports of delinquent behavior ($P = .86$). However, control children reported greater perceptions of a mean and scary world than intervention children at baseline ($P = .02$). Effects of the intervention are presented as differences between intervention and control groups at posttest (treatment minus control), adjusted for the baseline level of the dependent variable, sex and age, with 95% confidence intervals. There were no significant treatment \times sex or treatment \times age interactions for any of the outcomes, so main effects of the intervention are presented for boys and girls together, adjusted for sex and age. The results did not change when parental educational level was included as an additional covariate for the subsample of children with completed parent interviews.

As shown in the Table, compared with controls, children in the intervention group had statistically significant decreases in peer ratings of aggression, the primary outcome measure, and observed verbal aggression on the

Aggressive Behavior and Attitudes*

	Baseline		Posttest		Adjusted Difference (95% CI)	P
	Intervention	Control	Intervention	Control		
Peer-rated aggression, % nominated						
Boys	11.4 (14.0)	13.7 (14.9)	14.5 (16.3)	19.4 (17.0)	-2.4 (-4.6 to -0.2)	.03
Girls	5.5 (4.5)	5.4 (7.8)	8.2 (10.5)	10.3 (12.2)		
Observed physical aggression, acts per minute						
Boys	0.51 (0.42)	0.56 (0.72)	0.21 (0.27)	0.42 (0.89)	-0.09 (-0.29 to 0.11)	.35
Girls	0.18 (0.24)	0.29 (0.31)	0.10 (0.28)	0.07 (0.14)		
Observed verbal aggression, acts per minute						
Boys	1.25 (0.61)	1.00 (0.71)	0.16 (0.17)	0.24 (0.25)	-0.10 (-0.18 to -0.03)	.01
Girls	0.47 (0.43)	0.86 (0.66)	0.07 (0.10)	0.19 (0.22)		
Perceptions of a mean and scary world, 0-12 scale						
Boys	4.30 (2.22)	5.19 (2.31)	4.38 (2.03)	4.68 (1.96)	-0.30 (-0.84 to 0.23)	.26
Girls	5.45 (2.40)	6.24 (1.53)	5.24 (2.02)	6.24 (1.87)		
Parent reports of aggressive behavior, 0-40 scale						
Boys	9.23 (5.50)	10.40 (5.82)	9.18 (6.17)	10.86 (6.35)	-0.65 (-1.86 to 0.56)	.29
Girls	7.86 (5.53)	6.88 (5.19)	6.79 (4.34)	6.45 (4.70)		
Parent reports of delinquent behavior, 0-26 scale						
Boys	1.95 (1.61)	2.40 (1.96)	2.00 (1.77)	2.36 (2.14)	0.08 (-0.39 to 0.55)	.74
Girls	1.28 (1.25)	1.03 (1.45)	1.45 (1.15)	1.06 (1.27)		

*All data are presented as mean (SD) unless otherwise stated. CI indicates confidence interval.

playground. In addition, although not statistically significant, the direction of the differences favored the intervention group for all other outcome variables except parent reports of delinquent behaviors, which were very rare in both groups.

Equivalent Cohen effect sizes (the differences divided by the within-group SDs) were 0.29 for peer-nominated aggression and 0.53 for observed verbal aggression, generally considered small to medium and medium effects, respectively.²⁹ The nonsignificant differences represented Cohen effect sizes of 0.18 for observed physical aggression, 0.17 for perceptions of a mean and scary world, 0.18 for parent reports of aggressive behavior, and 0.06 for parent reports of delinquent behavior.

Although the sample size was insufficient to formally test for effects within subgroups, it was desirable to further characterize the effects of the intervention on participants with varying levels of aggression at baseline, with a descriptive analysis. To do so, we compared intervention and control group changes within strata defined by baseline levels of the outcome measures. In general, effects of the intervention occurred across the entire distribution of baseline values for all outcomes, with greater intervention vs control differences among those children who had medium and higher aggression levels at baseline.

COMMENT

In this study, an intervention to reduce television, videotape, and video game use decreased aggressive behavior in third- and fourth-grade schoolchildren. Because the

intervention targeted reduction of media use alone, without substituting alternative behaviors or activities, these results are also additional evidence for the causal effects of these media on children's aggressive behavior.³⁰ Aggressive behavior is determined by complex interactions between biological and socioenvironmental influences.³¹ This intervention attempted to mitigate only one of those influences, modeling of aggressive behavior in television, videotaped movies, and video games. Cognitive social learning explanations of aggression suggest that exposure to aggressive acts in the media provides opportunities for children to learn aggressive behaviors and to develop beliefs about the potential utility and consequences of using aggression to resolve conflicts.^{15,32} Consistent with this model, our findings demonstrate that reducing exposure to media results in reductions in children's aggressive behaviors.

In response to the intervention, children had statistically significant decreases in peer ratings of aggression (the primary outcome measure) and directly observed verbal aggression, compared with controls. The peer-nomination measure used is often considered the primary measure of aggression in studies of childhood aggression because of its exceptional psychometric properties.^{17,19,20} We also included observations of aggression on the playground because of their appeal as direct assessments of actual behavior. Despite the fact that observations were performed on a much smaller sample, the intervention effects on verbal aggression (an average intervention-control difference of 0.1 act per minute per child) were large enough to be statistically significant. There was a similar average intervention-control difference in the number of physically aggressive acts per

minute, but the variation in this measure was larger and the difference was not statistically significant.

The lack of statistically significant effects for parent reports of aggressive and delinquent behaviors may suggest that the intervention, and the influences of media exposure, are more specific to aggression at school than at home. However, the direction of the differences in parent reports of aggression did favor the intervention group and the effect size was similar to that for observed physical aggression on the playground. As a result, this finding could also be explained by insufficient statistical power, due to the lower reliability and sensitivity to change of parent report measures. It is also possible that parents have fewer opportunities to see their children act aggressively than their peers, or that parent ratings are less sensitive to change. Parent reports of delinquent behaviors were very rare in both groups in this study, so it is not surprising that we did not find an intervention-control difference for this variable. Although intervention-control differences in perceptions of a mean and scary world also favored the intervention, this difference also was not statistically significant. Again, however, this study may have been insufficiently powered to detect small changes in this measure.

This study has several limitations. First, because this study involved children in only 2 elementary schools, we cannot completely rule out the possibility that the results were due to differences in the intervention and control groups that were unrelated to the intervention. This possibility is made less likely, however, because the schools were in a single school district and participants were comparable at baseline on almost all measured variables. Second, the intervention targeted all television, videotape, and video game use, instead of just violent media. In addition, we did not assess specific exposure to violent media so we do not know whether violent media exposure was reduced. As a result, it may be argued that we have not sufficiently tested the causal relationship between violent media and aggressive behavior. However, we decided on the present design for practical reasons: in the current multimedia, multichannel, remote control environment, actual exposure to violent content is extremely difficult to assess accurately; the definition of what constitutes violent media is not necessarily straightforward; requiring parents and children to differentiate violent media from other types of content would make the intervention less likely to be adopted and less generalizable; and reduction in aggressive behavior is only one hypothesized benefit of reducing media use. However, because the intervention did not target just violent media, potentially diluting intervention effects, others may argue that our findings are even stronger evidence of the benefits of reducing media use on aggressive behavior.

Strengths of this study include the randomized controlled trial design; blinding of students, parents, and teachers to the specific study hypotheses; blinding of data collectors to experimental assignment; the use of multiple measures of aggression from different sources, including the highly reliable and valid peer nomination measure and playground observations with good inter-

rater reliability; the use of a potentially generalizable intervention delivered by the regular classroom teachers; and the analysis approach, which appropriately accounted for the design with the school as the unit of randomization.

Despite substantial evidence linking violent media with increased aggression, there have been few previous studies of approaches to reduce this effect.³⁰ This small study indicates that reducing television, videotape, and video game use may be a particularly promising approach to reducing children's aggressive behavior. Furthermore, even small and medium-sized effects may produce large benefits when applied to a population in a public health intervention.³³ The effects of this intervention occurred throughout the entire sample, although reductions in aggressive behavior were generally larger among children who were more aggressive at the beginning of the study. Although the analysis was limited by the small sample size, there was no evidence that the intervention was differentially effective in boys and girls. It will now be important to replicate this study with larger and more sociodemographically diverse samples and longer follow-up to confirm these findings and to evaluate the generalizability of this approach. Studies of the mechanisms by which this intervention influences aggressive behavior will also improve our understanding of the relationships between exposure to aggression in the media and subsequent aggressive behavior. In addition, to inform public policy, future studies should be designed to identify whether subgroups of children are more or less likely to respond to the intervention, and the elements of the curriculum and implementation most closely linked to reductions in children's aggression.

Accepted for publication August 23, 2000.

This study was funded by grants from the American Heart Association, California Affiliate; grant RO1 HL54102 (Dr Robinson) from the National Heart, Lung and Blood Institute, Bethesda, Md; the Children's Health Research Fund at Lucile Packard Children's Hospital at Stanford, Palo Alto, Calif; and a Robert Wood Johnson Foundation Generalist Physician Faculty Scholar Award.

We are indebted to Joel D. Killen, PhD, Helena C. Kraemer, PhD, Dina L. G. Borzekowski, EdD, Sally McCarthy, Connie Watanabe, MA, Melissa Nichols Saphir, PhD, and the students, teachers, and administrators who participated in this project.

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